In the Claims:

Please cancel claims 7-8, 10, 12-13, and 17-28. Please amend claims 6, 9, 11, and 15. Please add new claims 29-45. The claims are as follows:

1. (Original) A method of forming a polymer nanocomposite comprising the steps of:

selecting a clay having a layered structure and a polymer, said selecting satisfying

$$|S_p - S_{scf}| > |S_c - S_{scf}| \text{ and } |S_c - S_{scf}| \leq 2.0 \text{ (cal/cm}^3)^{0.5},$$

wherein S_p is a solubility parameter of the polymer, S_c is a solubility parameter of the clay; and S_{scf} is a solubility parameter of a supercritical fluid (SCF);

mixing the polymer and the clay to form a polymer-clay mixture;

melting the polymer-clay mixture to form a polymer-clay melt;

initially contacting the polymer-clay melt with the SCF while the SCF is subject to an initial pressure exceeding the critical pressure of the SCF and to a temperature exceeding the critical temperature of the SCF; and

after said initially contacting step, further contacting the polymer-clay melt with the SCF while the SCF is subject to a lower pressure that is less than the critical pressure of the SCF so as to exfoliate the clay to form the nanocomposite having the exfoliated clay being substantially dispersed throughout the polymer-clay melt.

2. (Original) The method of claim 1, wherein during the initially contacting and further contacting steps the SCF is subject to a pressure which decreases monotonically from the initial pressure to the lower pressure.

3. (Original) The method of claim 1, wherein during the initially contacting and further contacting steps the SCF is subject to a pressure which decreases non-monotonically from the initial pressure to the lower pressure.

4. (Original) The method of claim 1, wherein during the initially contacting and further contacting steps the SCF is subject to a pressure which varies essentially continuously from the initial pressure to the lower pressure.

5. (Original) The method of claim 1, wherein during the initially contacting and further contacting steps the SCF is subject to a pressure which varies essentially discontinuously from the initial pressure to the lower pressure.

6. (Currently amended) ~~The method of claim 1~~ A method of forming a polymer nanocomposite comprising the steps of:

selecting a clay having a layered structure and a polymer, said selecting satisfying

$$|S_p - S_{scf}| > |S_c - S_{scf}| \text{ and } |S_c - S_{scf}| \leq 2.0 \text{ (cal/cm}^3\text{)}^{0.5},$$

wherein S_p is a solubility parameter of the polymer, S_c is a solubility parameter of the clay; and S_{scf} is a solubility parameter of a supercritical fluid (SCF);

mixing the polymer and the clay to form a polymer-clay mixture;

melting the polymer-clay mixture to form a polymer-clay melt;

initially contacting the polymer-clay melt with the SCF while the SCF is subject to an initial pressure exceeding the critical pressure of the SCF and to a temperature exceeding the critical temperature of the SCF; and

after said initially contacting step, further contacting the polymer-clay melt with the SCF while the SCF is subject to a lower pressure that is less than the critical pressure of the SCF so as to exfoliate the clay to form the nanocomposite having the exfoliated clay being substantially dispersed throughout the polymer-clay melt, wherein the initially contacting and further contacting steps include flowing the polymer-clay melt and the SCF within an extruder and through a first region along a screw comprised by the extruder and through a second region in the extruder beyond screw such that the polymer-clay melt and SCF exit the extruder at a

bounding surface of the second region to a third region outside the extruder, wherein either the lower pressure does not exist within the first region and exists within the second region or the lower pressure exists within the first region.

7-8. (Canceled).

9. (Currently amended) The method of claim [[6]] 1, wherein the initially contacting and further contacting steps include flowing the polymer-clay melt and the SCF within an extruder and through a first region along a screw comprised by the extruder and through a second region in the extruder beyond screw such that the polymer-clay melt and SCF exit the extruder at a bounding surface of the second region to a third region outside the extruder, wherein the lower pressure does not exist within the extruder, and wherein the lower pressure exists within the third region.

10. (Canceled)

11. (Currently amended) The method of claim 1, wherein said mixing the polymer and the clay is performed using a co-rotating twin screw extruder.

12-13. (Canceled)

14. (Original) The method of claim 1, wherein the polymer is selected from a group consisting of high density polyethylene, low density polyethylene, nylon 6, nylon 6, 6, poly(acrylonitrile), poly(ethylene terephthalate), poly(acetal), poly(propylene), polystyrene, poly(vinyl acetate-co-vinyl alcohol), poly(vinylidene chloride), poly(vinylidene fluoride), and poly(vinyl alcohol).

15. (Currently amended) The method of claim 1, wherein the clay comprises at least one of ~~an aliphatic fluorocarbon, perfluoroalkylpolyether, quarternary ammonium terminated poly(dimethylsiloxane), an alkyl quarternary ammonuim complex, glass fibers, carbon fibers, carbon nanotubes~~, talc, mica, natural smectite clay, synthetic smectite clay, montmorillonite, saponite, hectorite, vermiculite, beidellite, or stevensite.

16. (Original) The method of claim 1, wherein the supercritical fluid comprises at least one of a hydrodcarbon, a cholrinated hydrocarbon, a fluorinated hydrocarbon, a chlorofluorohydrocarbon, an alcohol, a ketone, an ether, CO_2, H_2O, N_2, or O_2.

17-28. (Canceled)

29. (New) The method of claim 1, wherein said selecting comprises determining that the polymer, the clay, and the supercritical polymer satisfy

$$|S_p - S_{scf}| > |S_c - S_{scf}| \text{ and } |S_c - S_{scf}| \leq 2.0 \text{ (cal/cm}^3)^{0.5}.$$

30. (New) A method of forming a polymer nanocomposite comprising the steps of:

selecting a material and a polymer, wherein the material comprises a swelling agent having a layered structure, said selecting satisfying

$$|S_p - S_{scf}| > |S_c - S_{scf}| \text{ and } |S_c - S_{scf}| \leq 2.0 \text{ (cal/cm}^3)^{0.5},$$

wherein S_p is a solubility parameter of the polymer, S_c is a solubility parameter of the swelling agent; and S_{scf} is a solubility parameter of a supercritical fluid (SCF);

mixing the polymer and the material to form a mixture of the polymer and the material;

melting the mixture to form a melt;

initially contacting the melt with the SCF while the SCF is subject to an initial pressure exceeding the critical pressure of the SCF and to a temperature exceeding the critical temperature of the SCF; and

after said initially contacting step, further contacting the melt with the SCF while the SCF is subject to a lower pressure that is less than the critical pressure of the SCF so as to exfoliate the swelling agent to form the nanocomposite having the exfoliated swelling agent being substantially dispersed throughout the melt.

31. (New) The method of claim 30, wherein said selecting comprises determining that the polymer, the swelling agent, and the supercritical polymer satisfy

$$|S_p - S_{scf}| > |S_c - S_{scf}| \text{ and } |S_c - S_{scf}| \leq 2.0 \text{ (cal/cm}^3)^{0.5}.$$

32. (New) The method of claim 30, wherein the material further comprises a filler, and wherein the filler comprises carbon nanotubes.

33. (New) The method of claim 30, wherein during the initially contacting and further contacting steps the SCF is subject to a pressure which decreases monotonically from the initial pressure to the lower pressure.

34. (New) The method of claim 30, wherein during the initially contacting and further contacting steps the SCF is subject to a pressure which decreases non-monotonically from the initial pressure to the lower pressure.

35. (New) The method of claim 30, wherein during the initially contacting and further contacting steps the SCF is subject to a pressure which varies essentially continuously from the initial pressure to the lower pressure.

36. (New) The method of claim 30, wherein during the initially contacting and further contacting steps the SCF is subject to a pressure which varies essentially discontinuously from the initial pressure to the lower pressure.

37. (New) The method of claim 30, wherein the initially contacting and further contacting steps include flowing the melt and the SCF within an extruder and through a first region along a screw comprised by the extruder and through a second region in the extruder beyond screw such that the melt and SCF exit the extruder at a bounding surface of the second region to a third region outside the extruder.

38. (New) The method of claim 37, wherein either the lower pressure does not exist within the first region and exists within the second region or the lower pressure exists within the first region.

39. (New) The method of claim 37, wherein the lower pressure does not exist within the extruder, and wherein the lower pressure exists within the third region.

40. (New) The method of claim 30, wherein said mixing the polymer and the material is perfomed using a co-rotating twin screw extruder.

41. (New) The method of claim 30, wherein the polymer is selected from a group consisting of high density polyethylene, low density polyethylene, nylon 6, nylon 6, 6, poly(acrylonitrile), poly(ethylene terephthalate), poly(acetal), poly(propylene), polystyrene, poly(vinyl acetate-co-vinyl alcohol), poly(vinylidene chloride), poly(vinylidene fluoride), and poly(vinyl alcohol).

42. (New) The method of claim 30, wherein the supercritical fluid comprises at least one of a hydrodcarbon, a cholrinated hydrocarbon, a fluorinated hydrocarbon, a chlorofluorohydrocarbon, an alcohol, a ketone, an ether, CO_2, H_2O, N_2, or O_2.

43. (New) The method of claim 30, wherein the swelling agent comprises a clay.

44. (New) The method of claim 43, wherein the clay is selected from the group consisting of talc, mica, natural smectite clay, synthetic smectite clay, saponite, hectorite, vermiculite, beidellite, stevensite, and combinations thereof.

45. (New) The method of claim 43, wherein the clay comprises montmorillonite.